



Aalto University
School of Engineering

MEC-E2009 Marine Risks and Safety

“Regulatory issues in maritime safety”

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Intended Learning Outcomes

After this lecture, the student should:

1. Understand the main aspects of the maritime safety regime
2. Know the main maritime safety actors
3. Know the main maritime safety related regulations
4. Be able to find the relevant regulations and apply those when necessary

Introduction to legal regime of the seas

Legal Regime of the seas: Fundamental ambiguity

SHIP

- Beneficial for international trade to allow ships to navigate freely, with minimal restrictions
- Ships navigate worldwide

COASTAL STATE

- Has certain safety, environmental and economic interests and concerns about maritime activities in waters near to its territory
- Has a set of laws to regulate the activities in its territory

A certain legal regime is needed to regulate the activities onboard the ship and how it interacts with its environment

Solution: international treaties

United Nations Convention of the Law of the Sea (UNCLOS III, 1982)



International agreement between sovereign states to regulate which jurisdiction is applicable when.

- **Flag states** set requirements on interactions between persons onboard (criminal, fiscal,...)
- **Flag states** agree internationally on ship standards
- **Coastal states** have the right to set additional requirements, under certain conditions

Ship nationality and jurisdiction

Art. 91

Ships have the nationality of the State whose flag they are entitled to fly

Art. 92

Ships shall [...], save in exceptional cases expressly provided for in international treaties or in this Convention, be subject to its exclusive jurisdiction on the high seas

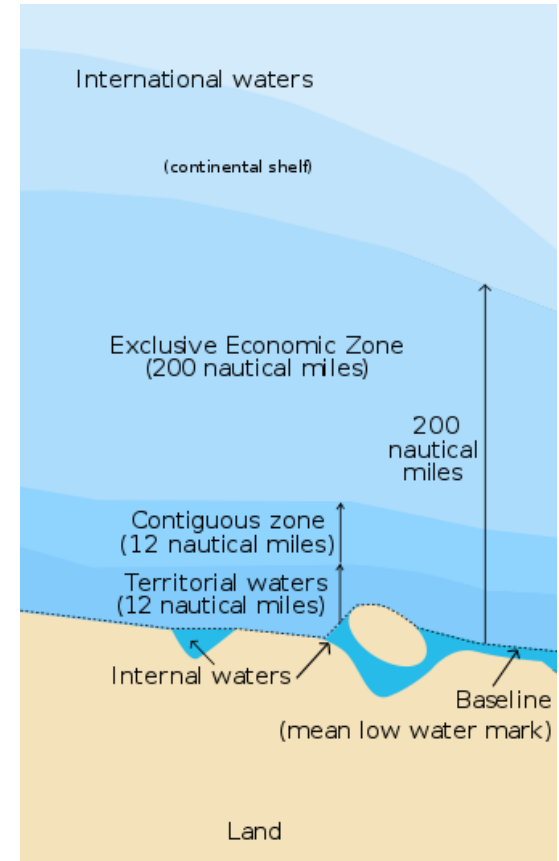
Different legal regimes for different maritime geographic zones

Basic principle:

The closer to the land of the Coastal State, the more jurisdictional powers the State has

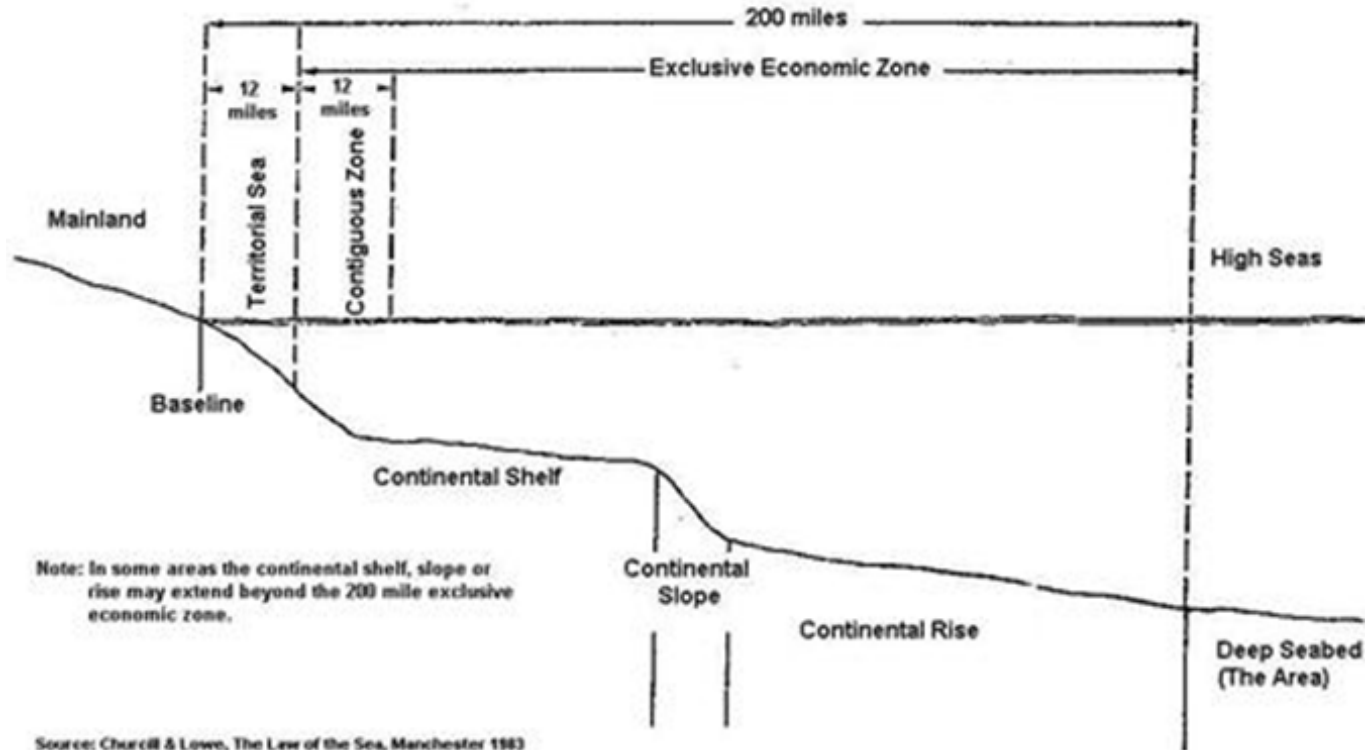
Different geographical zones (maritime):

- Internal waters (< baseline)
- Territorial waters (< 12nm)
- Contiguous Zone (< 24nm)
- Exclusive Economic Zone (< 200nm)
- High Seas (> 200nm)



Distinction between water and seabed

An illustration on the different legal zones in the marine area under 1982 UNCLOS was shown:



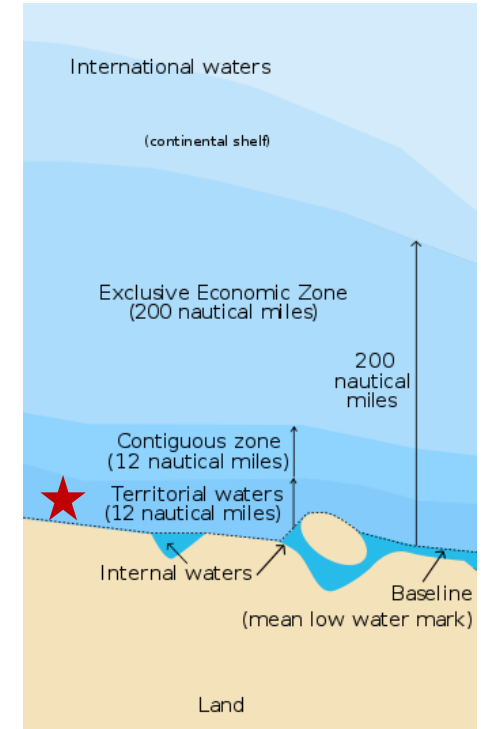
Territorial waters (1)

Art. 2: Delineation of the Territorial Waters

The sovereignty of a Coastal State extends beyond its land territory and internal waters [...] to an adjacent belt of sea, described as the territorial sea.

Art. 17: Innocent passage

Ships of all States [...] enjoy the right of innocent passage through the territorial sea.



Territorial waters (2)

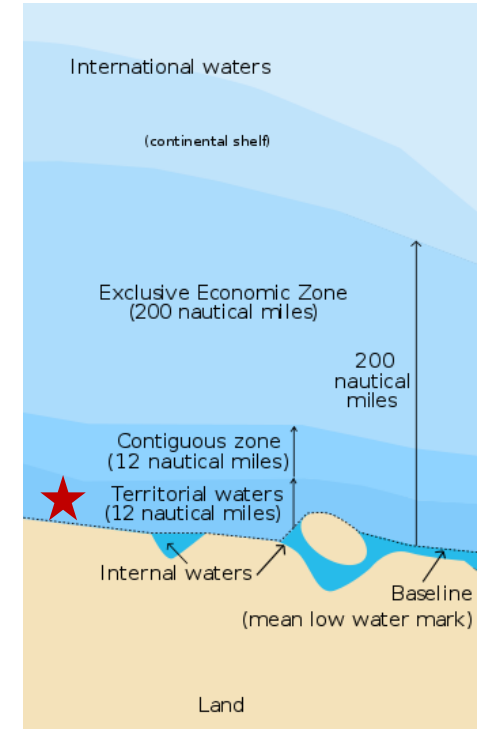
Art. 18: Passage

Passage means continuous and expeditious [...] traversing of that sea [...] or proceeding to or from internal waters or call at a port facility

Art. 19: Innocent

Passage is innocent so long as it is not prejudicial to the peace, good order or security of the coastal State.

Non-innocent passage is e.g. military operations, willful pollution, fishing,...



Territorial waters (3)

Art. 21: Regulation of passage

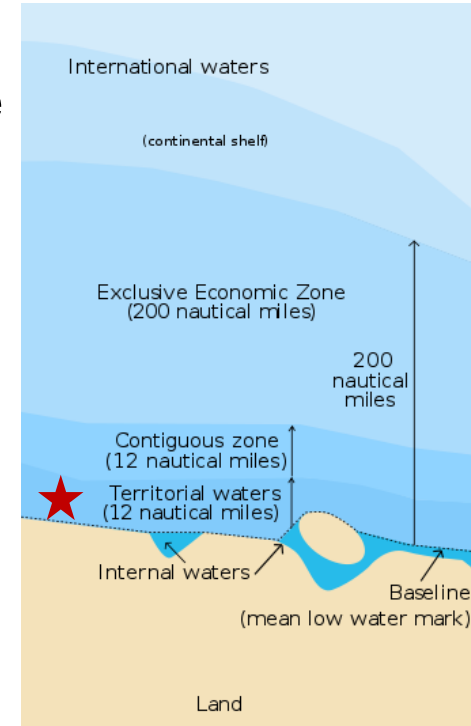
Art. 21(1) The coastal State may adopt laws and regulations [...] relating to innocent passage through the Territorial sea

(a) Safety of navigation and the regulation of maritime traffic

(f) The preservation of the environment of the coastal State and the prevention, reduction and control of pollution there

e.g. Mandatory pilotage, restriction of use of fuels, prohibition of dumping wastes

Art. 21(2) Such laws and regulations shall not apply to the design, construction, manning or equipment of foreign ships

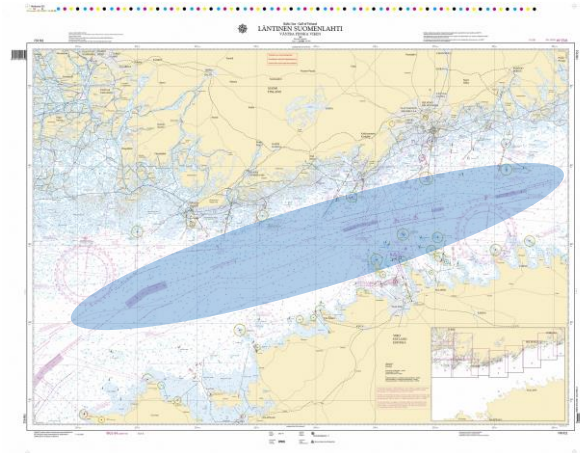


UNCLOS III, 1982

Territorial waters (4)

Art. 21: Regulation of passage

Art. 21(1) The coastal State may [...] require foreign ships [...] to use such sea lanes and traffic separation schemes as it may designate for the regulation of the passage of ships



Traffic separation in
Gulf of Finland

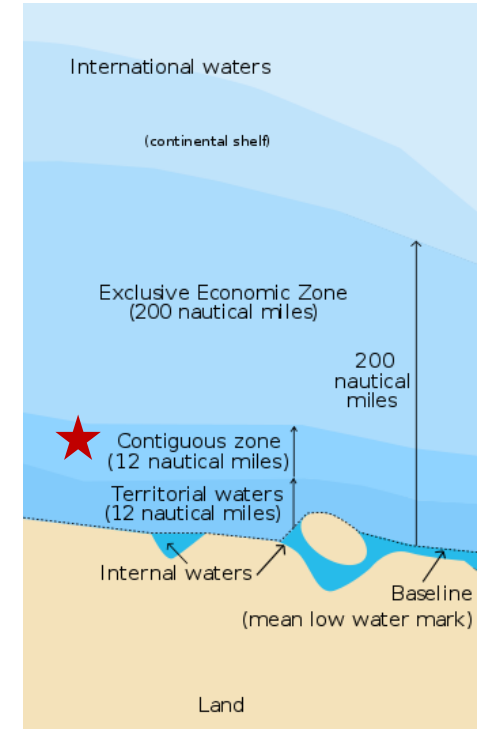
Contiguous Zone

Art. 33: Rights of Coastal State in Contiguous Zone

In a zone contiguous to its territorial sea [...], the coastal State may exercise the control necessary to

(a) Prevent infringement of its customs, fiscal, immigration or sanitary laws and regulations within its territory or territorial sea

(b) Punish infringement of the above laws and regulations committed within its territory or territorial sea



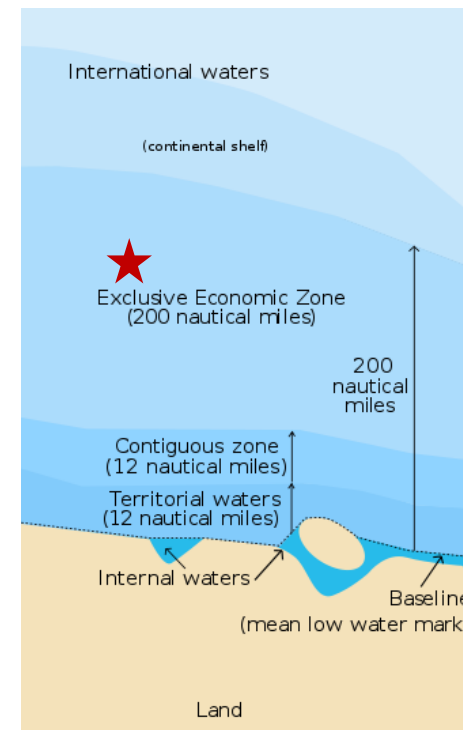
Exclusive Economic Zone (EEZ) (1)

Art. 56(1): Rights of coastal State in EEZ

The coastal State has:

(a) Sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources [...] and with regard to other activities for the economic exploitation and exploration of the zone

(b iii) Jurisdiction with regard to [...] the protection and preservation of the marine environment



Exclusive Economic Zone (EEZ) (2)

Art. 221(6a) Limitation of Rights of Coastal State in EEZ

Coastal State jurisdiction with respect to environmental matters should

- have reasonable grounds
- be communicated to competent international organization (IMO) and to other states concerned

E.g. SECA areas (see MARPOL Annex VI)

- Aim is to reduce emissions of SO_x because it harms living creatures in the sea
- Achieved through limiting Sulphur content in maritime fuels



High Seas

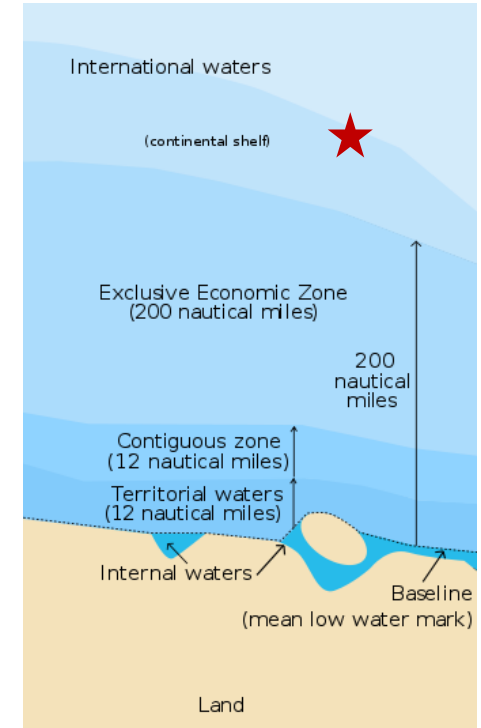
Art. 87: Freedom of the High Seas

High Seas: those parts of the seas where no State has privileged rights

Art. 87(1): The High Seas are open to all States, whether coastal or land-locked

- (a) Freedom of navigation
- (b) Freedom of fishing
- (f) Freedom of scientific research

Art. 87(2): These freedoms shall be exercised by all States with due regard for the interests of other States [...]



UNCLOS III, 1982

Legal regime: summary

- Basic rule is that ship design, construction, manning and requirements of carriage of equipment is a **Flag State** competence, relating to the “freedom of the high seas”
- Requirements related to these aspects therefore need to be agreed between Flag States in appropriate venues
- Only under certain conditions can **Coastal States** require additional measures to enhance safety or protect the environment.

Maritime safety actors

Overview

Flag State

International Maritime Organisation
Classification Societies

Port state

European Maritime Safety Agency
Vessel Traffic Services
Pilotage services
Icebreaking services
Pollution response authorities

Industry Organizations

International Association of Classification Societies
International Association of Lighthouse Authorities
Permanent International Commission for Navigation Congresses
Baltic Marine Environmental Protection Commission

Note! This overview contains only the main actors. There are more.

Flag State



- Development of national rules and regulations
- Participate in work of IMO, EMSA and other international bodies
- Ratification, adoption and implementation of international regulation
- Enforcement of national and international regulation
I.e., Flag State control
 - Construction control
 - Inspection of work standards
 - Setting requirements for manning level and competence
 - Inspection of ship and crew
- Authority may be delegated to recognized organizations
- In Finland: The Finnish Transport and Communications Agency (Traficom)

International Maritime Organization (IMO)



- UN Agency, established in 1948
 - Consultative and authoritative
 - Responsibility for:
 - Safety of sea and protection of the marine environment
 - Legal matters connected with international shipping and maritime traffic
 - Facilitates cooperation among governments on technical matters to achieve highest practicable standards
 - Develops conventions, resolutions, codes and guidelines
 - Several committees:
 - MSC: Maritime Safety Committee
 - MEPC: Marine Environment Protection Committee
-

Classification Societies



- Independent, third-part organizations
- Aim to serve public interest and clients by promoting safety of life, property and the environment
- Development and verification of "Class Rules"
 - Standards for design, construction and operational maintenance of marine related facilities
 - Certification and survey of ships and other marine structures
- Undertaking statutory surveys and certification on the basis of international regulations, as delegated by Flag States
- Research related to rule updating in line with general aims



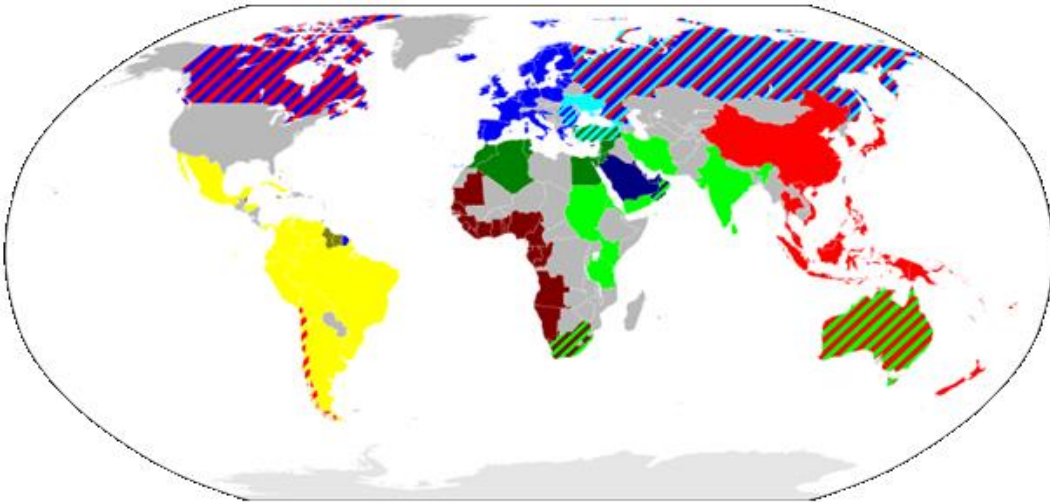
Port State (1)



- Coastal states have been dissatisfied with the quality of the Flag State control regime
- Additional control structure as secondary barrier to ensure ship safety
- Organized in regional clusters
- Basis for inspection: existing international regulations (no extra!)
SOLAS, ILLC, MARPOL, STCW,...
- Outcome of inspection:
 - ship in order
 - defect to be repaired before leaving port (basic principle)
 - defect to be repaired within due date (minor defects)
 - detention (serious safety hazards)

Port State (2)

- Port state control is organised in regional clusters (Memorandum of Understanding)
- Target: each state to inspect 25% of ships calling its ports



Paris MOU
Tokyo MOU
Acuerdo de Viña del Mar
Caribbean MOU
Mediterranean MOU
Indian Ocean MOU
Abuja MOU
Black Sea MOU
Riyadh MOU

- Established in 2002 (cf. Erika disaster)
- Technical and scientific advice to European Commission in the field of maritime safety and prevention of pollution by ships
- Key areas of work
 - Strengthening the Port State Control regime
 - Auditing the Community-recognized classification societies
 - Development of a common methodology for the investigation of maritime accidents
 - Establishment of a Community vessel traffic monitoring and information system



Vessel Traffic Services

- Marine traffic monitoring system, established by harbor or port authorities
- Services
 - **Information**
Providing information for on-board navigational decision making
 - **Traffic organization**
Prevention of development of dangerous traffic situations
 - **Navigational assistance**
Assisting onboard decision making and monitoring the effects, focus on difficult meteorological circumstances



Industry Organizations

- Several organizations provide guidelines, best practices and manuals for industry-specific safety and environmental safety
- International Chamber of Shipping (ICS)
- Oil Companies International Marine Forum (OCIMF)
- International Association of Independent Tanker Owners (INTERTANKO)
- Society of International Gas Tanker and Terminal Operators (SIGTTO)
- International Associations of Dry Cargo Shipowners (INTERCARGO)



International Association of Classification Societies (IACS)

- Established in 1968
- 10 members, IMO consultative status
- Common forum for members to work on marine safety and protection of the marine environment
- Development of
 - Unified requirements, unified interpretations
 - Guidelines and recommendations
 - Common structural rules (Bulk Carriers and Tankers)
- Cooperation with relevant international and national maritime and industry organizations

The logo for the International Association of Classification Societies (IACS), consisting of the letters "IACS" in a bold, blue, sans-serif font.

INTERNATIONAL ASSOCIATION OF CLASSIFICATION SOCIETIES LTD.

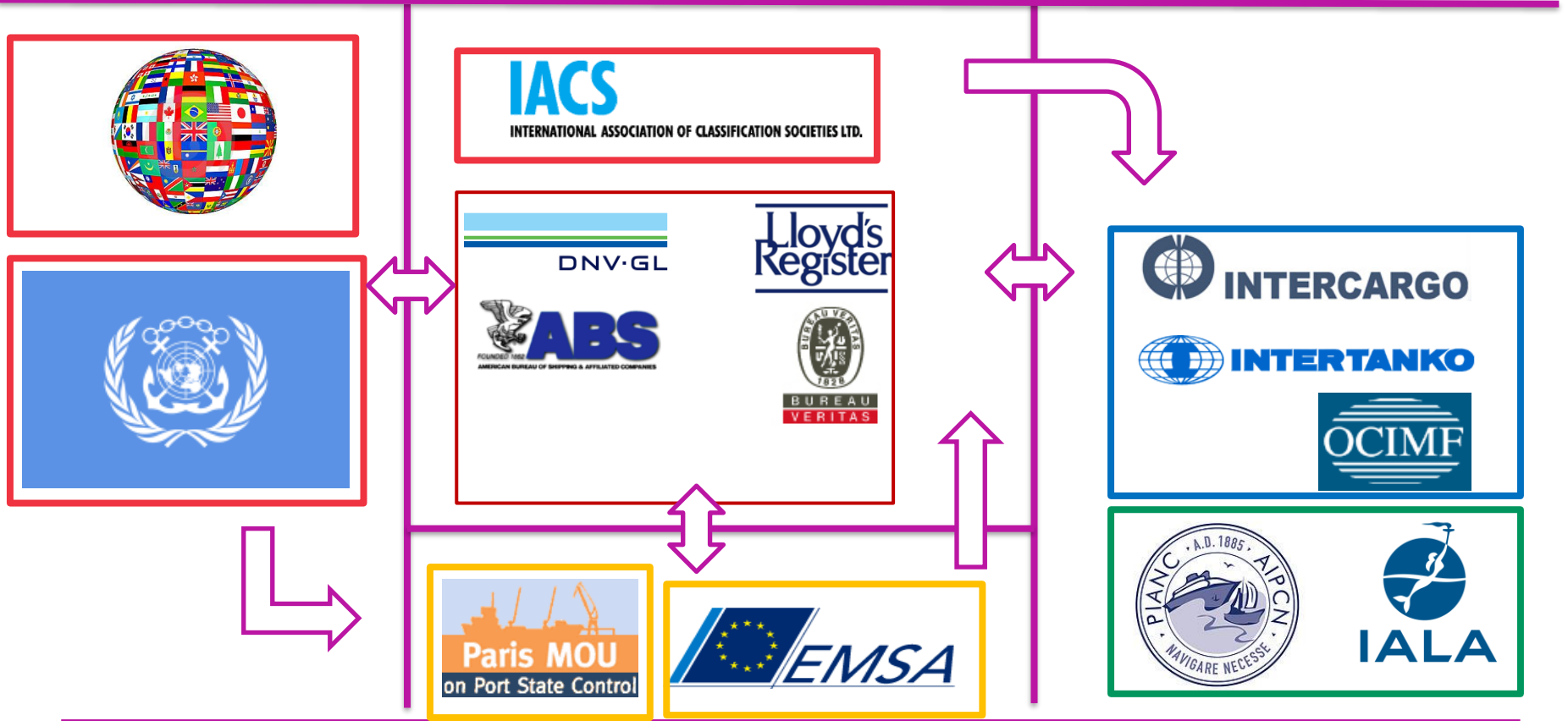
International Association of Lighthouse Authorities (IALA)

- Established in 1957
- Non-profit organisation providing nautical expertise in the field of marine aids to navigation
- Key areas of work:
 - Aids to navigation (buoys, lights,...)
 - E-Navigation: integration of existing and new navigational tools
 - Vessel Traffic Management: guidelines for training of VTS personnel

Permanent International Commission for Navigation Congresses (PIANC)

- Established in 1885
- Non-governmental organization promoting knowledge in the field of waterway design
- Key work areas
 - Port infrastructure
 - Navigation channels
 - Bank and shore protection
 - Environmental management (e.g. dredging)

Maritime safety actors (overview)



Maritime rules and regulations

General principles of conventions and codes

- Several authorities and regulatory bodies issue conventions, codes, regulations, recommendations, etc.
- Not all of these are adopted or implemented by each Flag or Coastal state, as doing so is a sovereign right of states
- Conventions have a starting date of validity.
This date of validity is important to consider when selecting the rules applicable to a given ship.

Overview: Mandatory Conventions

Abbreviation	Full name
SOLAS	International Convention on Safety of Life At Sea
MARPOL	International Convention for the Prevention of Pollution from Ships
ILLC	International Convention on Load Lines
STCW	International Convention on Standards of Training and Certification of Seafarers
COLREGs	Convention on the International Regulations for Preventing Collisions at Sea

Overview: Mandatory Associated Codes

Abbreviation	Full name
ISM Code	International Safety Management Code
Polar Code	International Code for Ships Operating in Polar Waters
ISPS Code	International Ship and Port Facility Security Code
IGC Code	International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
IBC Code	International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk
HCS Code	International Code of Safety for High-Speed Craft
IGC Code	International Code for the Safe Carriage of Grain in Bulk

Overview: Mandatory Associated Codes

Abbreviation	Full name
LSA Code	International Life Saving Appliances Code
FSS Code	International Fire Safety Systems Code
FTP Code	International Fire Test Procedures Code

Other mandatory rules regulations

Abbreviation	Full name
Class Rules	Rules for Classification of Ships
FSIC Rules	Finnish-Swedish Ice Class Rules

SOLAS (1)

Minimum standards for construction, equipment and operation

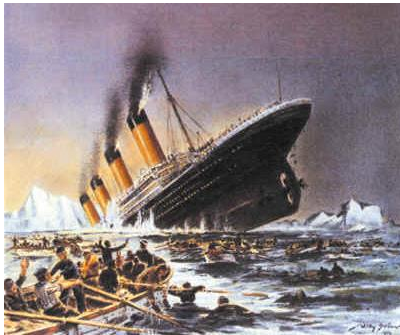


- | | |
|--|---|
| I. General provisions | VII. Carriage of dangerous goods |
| II. 1 - Construction – Subdivision and stability, machinery and electrical installations | VIII. Nuclear ships |
| 2 - Construction – Fire protection, detection and alarm | IX. Management for the Safe |
| III. Life-saving appliances and arrangements | XI. Special Measures to Enhance Safety |
| IV. Radiotelegraphy and radiotelephony | XII. Additional Safety Measures for Bulk Carriers |
| V. Safety of navigation | |
| VI. Carriage of grain | |

How many of this standards are somehow familiar to you and in which context? For example, reflect in the context of your ship design concept

SOLAS (2)

- 1st SOLAS in 1914
- Consequence of Titanic Disaster
- Several subsequent revisions and amendments



Examples of protective measures

- Fire zones: insulation of spaces
- Fire alarms
- Water sprinkler system
- Fire extinguishers
- Ventilation shut down in E/R
- Emergency shut down of fuel values in E/R
- Immersion suits
- Life boats



MARPOL (1)

Convention text, appended by a number of annexes addressing various types of pollution



Annex	Title
Annex I	Prevention of pollution by oil
Annex II	Prevention of pollution by noxious liquid substances
Annex III	Prevention of pollution by harmful substances in packaged form
Annex IV	Prevention of pollution by sewage
Annex V	Prevention of pollution by garbage
Annex VI	Prevention of air pollution

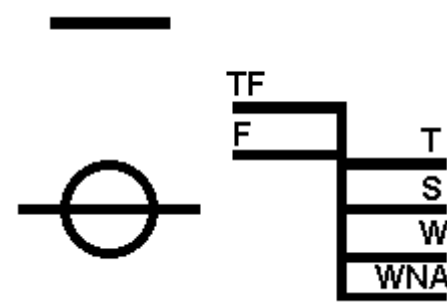
MARPOL (2)

Examples of protective measures

- Segregated ballast tanks (SBT)
Ballast tanks only used for ballast, not for cargo
- Protective location of SBT
In bottom or sides protecting cargo tanks against impact or penetration
- Tank size limitation
Limits potential oil outflow
- Crude oil washing (COW)
Use crude oil itself instead of water to wash the cargo tanks
- Inert gas system (IGC) for empty cargo tanks
- Slop tanks for containing slop, sludge and washings



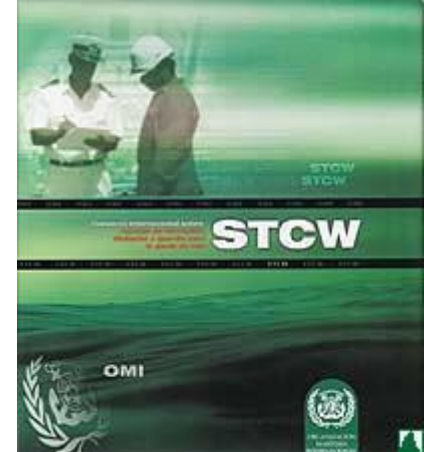
ILLC



- First Load Line Convention in 1966
- Deals with freeboard assignment and closing appliances
 - Chapter I – General
 - Chapter II – Conditions of assignment of freeboard
 - Chapter III – Freeboards
 - Chapter IV – Special requirements for ships assigned timber freeboards
- Examples of protective measures
 - Closing of doors in hull (e.g. stern door)
 - Air pipes, vent heads
 - Hatch closing arrangement

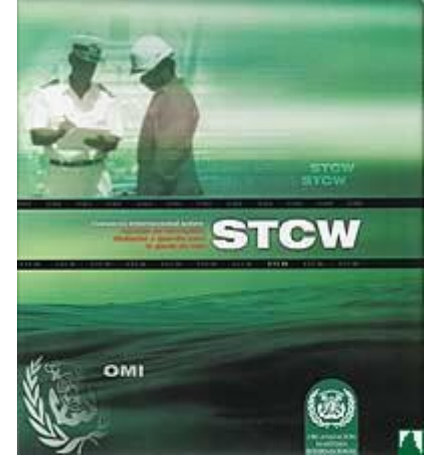
STCW (1)

- First STCW 1978, amended 1995
- Deals with manning proficiency
- **General provisions**
- **Master-deck department**
 - Basic principles to be observed in keeping a navigational watch
 - Mandatory minimum requirements for the certification of masters, chief mates and officers in charge of navigational watches on ships of 200GRT or more
- **Engine Department**
 - Basic principles to be observed in keeping an engineering watch
 - Mandatory minimum requirements for certification of officers of ships with main propulsion machinery of 3000kW



STCW (2)

- Radio department
- Special requirements for tankers
- Proficiency in survival craft



COLREG (1)

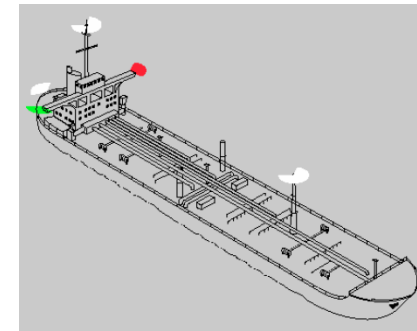
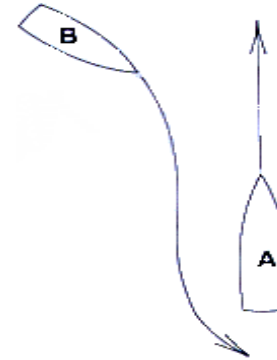
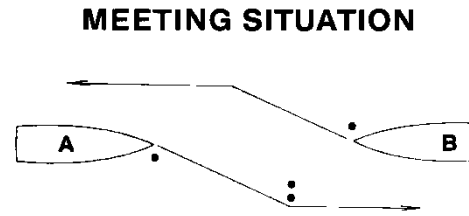
- First COLREG 1972
- Deals with "Rules of the Road"

- Part A: General
- Part B: Steering and Sailing
 - Sec. 1: Conduct of vessels in any condition of visibility
 - Sec. 2: Conduct of vessels in sight of one another
- Part C: Lights and Shapes
- Part D: Sound and Light Signals
- Part E: Exemptions



COLREG (2) examples

- Rule 14: Head-on encounter
 - Both vessels move to starboard
- Rule 15: Crossing encounter
 - The vessel that has the other on its starboard side is to keep clear
 - Avoid crossing ahead of the other vessel
- Rule 23: Power driven vessel underway
 - A masthead light forward
 - A second masthead light abaft of and higher than the forward one
 - Sidelights
 - A sternlight



ISM Code (1)



- First ISM Code 1993, amended 2014
- Objectives
 - To provide for safe practices in ship operation and safe working environment
 - To establish safeguards against all identified risks
 - To continuously improve the safety management skills of personnel ashore and aboards, including preparing for emergencies related both to safety and environmental protection
- Simply put
 - Strengthen the compliance to basic regulations
 - Introduce minimum **standard safety management**

ISM Code (2)

1. Definitions
 2. Safety and environmental protection policy
 3. Company responsibilities and authority
 4. Designated persons
 5. Master's responsibilities and authority
 6. Resources and personnel
 7. Ship board operations
 8. Emergency preparedness
 9. Reports and analysis of non-conformities, accidents and hazardous occurrences
 10. Maintenance of the ship and equipment
 11. Documentation
 12. Company verification, review and evaluation
-



Polar Code

HOW THE POLAR CODE PROTECTS THE ENVIRONMENT

First edition 2014

OIL



DISCHARGES
Discharge into the sea of oil or oily mixtures from any ship is prohibited



STRUCTURE
Double hull and double bottom required for all oil tankers, including those less than 5,000dwt (A/B ships constructed on or after 1 January 2017)



HEAVY FUEL OIL
Heavy fuel oil is banned in the Antarctic (under MARPOL). Ships are encouraged not to use or carry heavy fuel oil in the Arctic



LUBRICANTS
Consider using non-toxic biodegradable lubricants or water-based systems in lubricated components outside the underwater hull with direct seawater interfaces

INVASIVE SPECIES



INVASIVE AQUATIC SPECIES
Measures to be taken to minimize the risk of invasive aquatic species through ships' ballast water and biofouling

SEWAGE



DISCHARGES I
No discharge of sewage in polar waters allowed (except under specific circumstances)



TREATMENT PLANTS
Discharge is permitted if ship has an approved sewage treatment plant, and discharges treated sewage as far as practicable from the nearest land, any fast ice, ice shelf, or areas of specified ice concentration



DISCHARGES II
• Sewage not comminuted or disinfected can be discharged at a distance of more than 12nm from any ice shelf or fast ice
• Comminuted and disinfected sewage can be discharged more than 3nm from any ice shelf or fast ice

GARBAGE



PLASTICS
All disposal of plastics prohibited (under MARPOL)



FOOD WASTES I
Discharge of food wastes onto the ice is prohibited



FOOD WASTES II
Food wastes which have been comminuted or ground (no greater than 25mm) can be discharged only when ship is not less than 12nm from the nearest land, nearest ice shelf, or nearest fast ice



ANIMAL CARCASSES
Discharge of animal carcasses is prohibited



CARGO RESIDUES
Cargo residues, cleaning agents or additives in hold washing water may only be discharged if: they are not harmful to the marine environment; both departure and destination ports are within Arctic waters; and there are no adequate reception facilities at those ports. The same requirements apply to Antarctic area under MARPOL

BACKGROUND INFO

- THE INTERNATIONAL CODE FOR SHIPS OPERATING IN POLAR WATERS WILL ENTER INTO FORCE ON 1 JANUARY 2017
- IT APPLIES TO SHIPS OPERATING IN ARCTIC AND ANTARCTIC WATERS: ADDITIONAL TO EXISTING MARPOL REQUIREMENTS
- IT PROVIDES FOR SAFE SHIP OPERATION AND PROTECTS THE ENVIRONMENT BY ADDRESSING THE UNIQUE RISKS PRESENT IN POLAR WATERS BUT NOT COVERED BY OTHER INSTRUMENTS

DEFINITIONS



SHIP CATEGORIES
Three categories of ship designed to operate in polar waters in:
A) at least medium first-year ice
B) at least thin first-year ice
C) open waters/ice conditions less severe than A and B



FAST ICE: Sea ice which forms and remains fast along the coast, where it is attached to the shore, to an ice wall, to an ice front, between shoals or grounded icebergs

ICE SHELF: A floating ice sheet of considerable thickness showing 2 to 50m or more above sea-level, attached to the coast

CHEMICALS



DISCHARGES
Discharge of noxious liquid substances (NLS) or mixtures containing NLS is prohibited in polar waters



Rules for Classification of Ships

- Standards relating to specific technical fields, developed by Classification Societies, as delegated by Flag State
- Rules generally cover:
 - Structural strength and integrity of essential parts of the vessel's hull and its appendages
 - Safety and availability of the main functions
- E.g. DNV Rules
 - Pt1. General regulations
 - Pt2. Materials and welding
 - Pt3. Hull and equipment – main class
 - Pt4. Machinery and systems – main class
 - Pt5. Special service and type – additional class
 - Pt6. Special equipment and system – additional class
 - Pt7. Ships in operations

Finnish-Swedish Ice Class Rules

- Special design requirements for vessels operating in Baltic Sea ice conditions
- First edition 1971, last amendment 2019
- Scope:
 - Minimum engine output
 - Hull strength
 - Machinery
 - Rudder strength
- Different ice classes
 - related to icebreaker assistance and fairway dues
 - Equivalency of ice classes (Russian, Canadian, etc)



Autonomous Ships Regulatory Framework? (1)

Current maritime conventions do not consider autonomous ships

- The most significant challenges concern obligatory crew/shipmaster functions
 - *COLREGs, Rule 5: A ship must always maintain a proper lookout by sight and hearing...*
 - *COLREGs, Rule 2: Requires good seamanship*
 - *STCW: Officers in charge...shall be physically present on the navigation bridge...*
 - *SOLAS, Reg. 24: ...autopilot must enable an immediate switch from automatic to manual control*
 - *SOLAS, Reg. 33: The master of a ship is required to assist persons in distress at sea*
- SOLAS allows equivalent solutions, STCW does not
 - *Unmanned operations need to start on internal waters with special permission*
 - *A new international regulatory framework for unmanned ships is needed*

Autonomous Ships Regulatory Framework? (2)

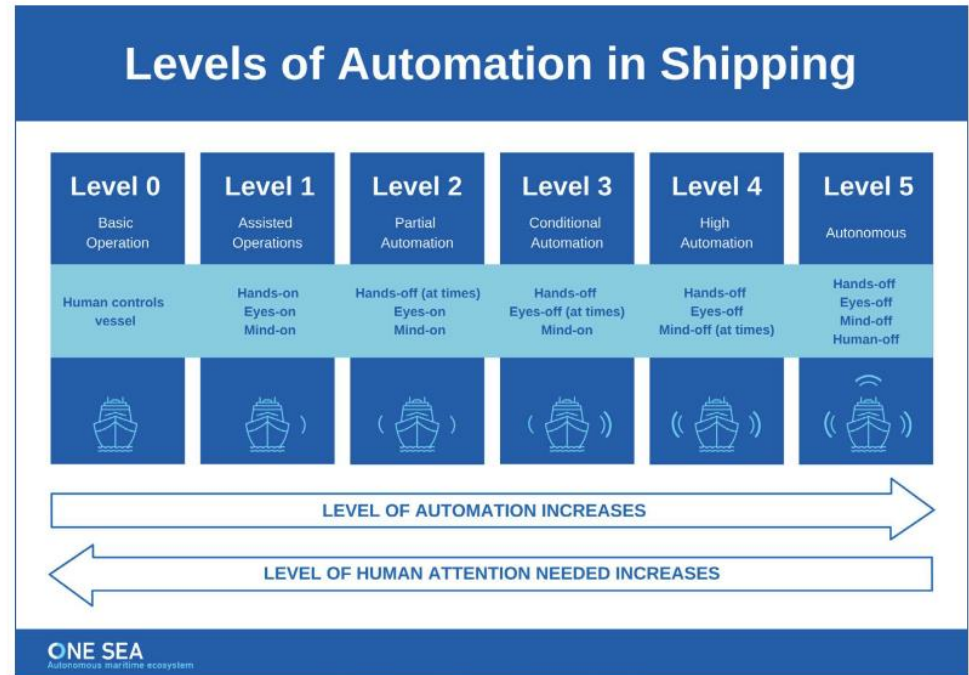
Alternatives proposed and the approach by IMO

- Initial attempt to decomposition/ categorization of four autonomy levels
 - Ship with automated processes and decision support
 - Remotely controlled ship with seafarers on board
 - Remotely controlled ship without seafarers on board
 - Fully autonomous ship
- Current approach, IMO aims to integrate new and advancing technologies in its regulatory framework
 - The MSC 105th session in April 2022 commenced work on the development of a goal-based instrument regulating the operation of MASS
 - A mandatory MASS Code will be developed and (planned) to enter into force on 1 January 2028
 - International Maritime Organization (IMO) drafted a road map describing the basis for the development of a goal-based instrument for MASS (MSC 105/7)

Autonomous Ships Regulatory Framework? (3)

Proposals in Finland

- One Sea Maritime Ecosystems (roots on the Society Automotive Engineers classification)
- It is a goal-based approach for specific context
- The final target (level 5) is the ship will be capable of coping with exceptions, unforeseen situations, anomalies, faults, etc., without needing human oversight





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Conclusions

Too much information?

Yes

However, rules and regulations are the main guidelines available to know **what** it should be done to ensure safety.

As naval architect, expert in marine technology or expert in maritime safety, you will be an expert on one or several of these regulations and you will decide **how** to ensure safety based on the guidelines.

Learning log 1

- The first learning log to be returned no later than Su. 10.9.2023 at 23:59
- Instructions for the learning log are given in Mycourses
- Please submit the log via Mycourses, if you have any question please contact victor.bolbot@aalto.fi
- General feedback to the logs will be given in the Lecture 2



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**Thanks for your
time and attention**